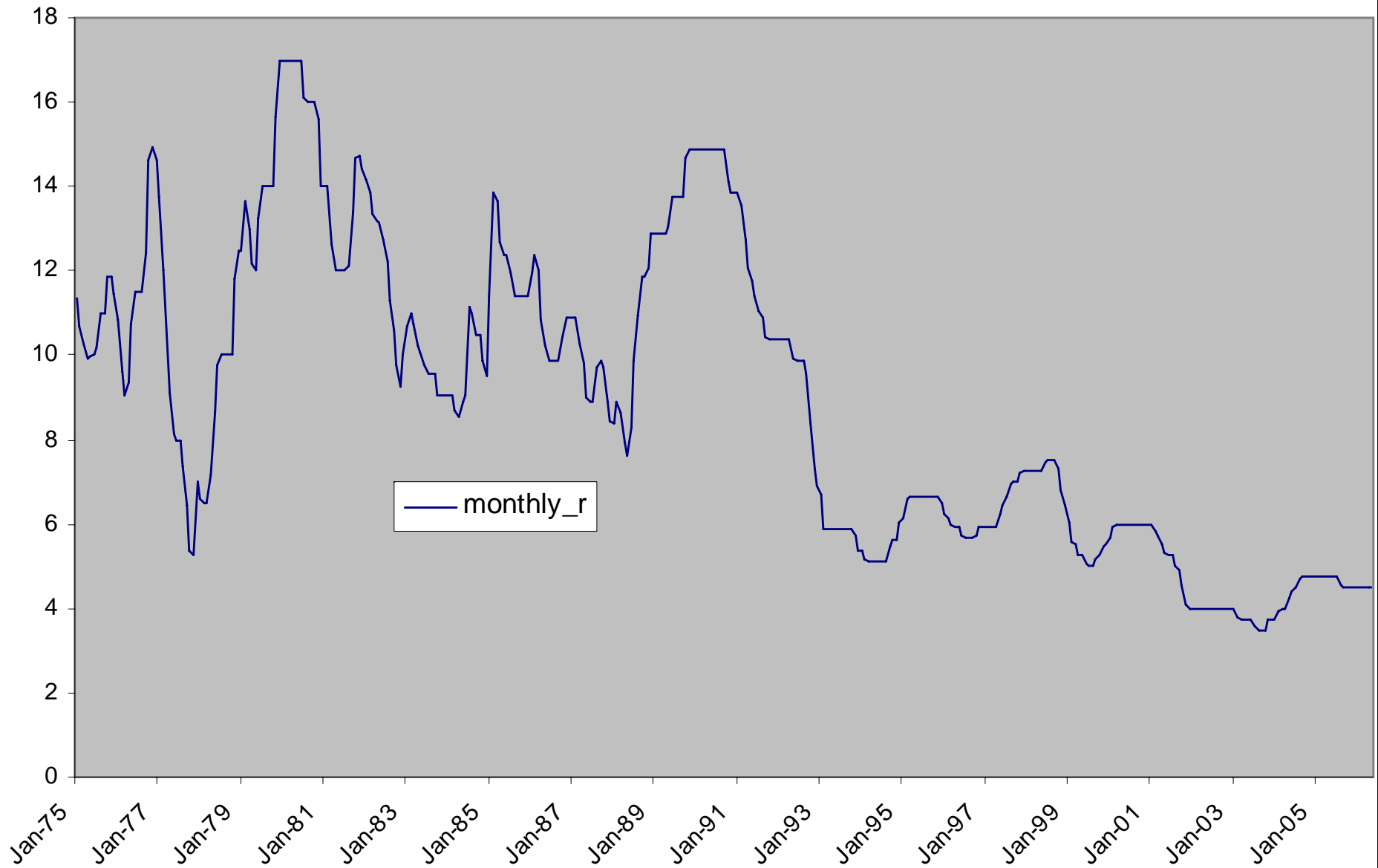


An Empirical Study of Interest Rate Determination Rules

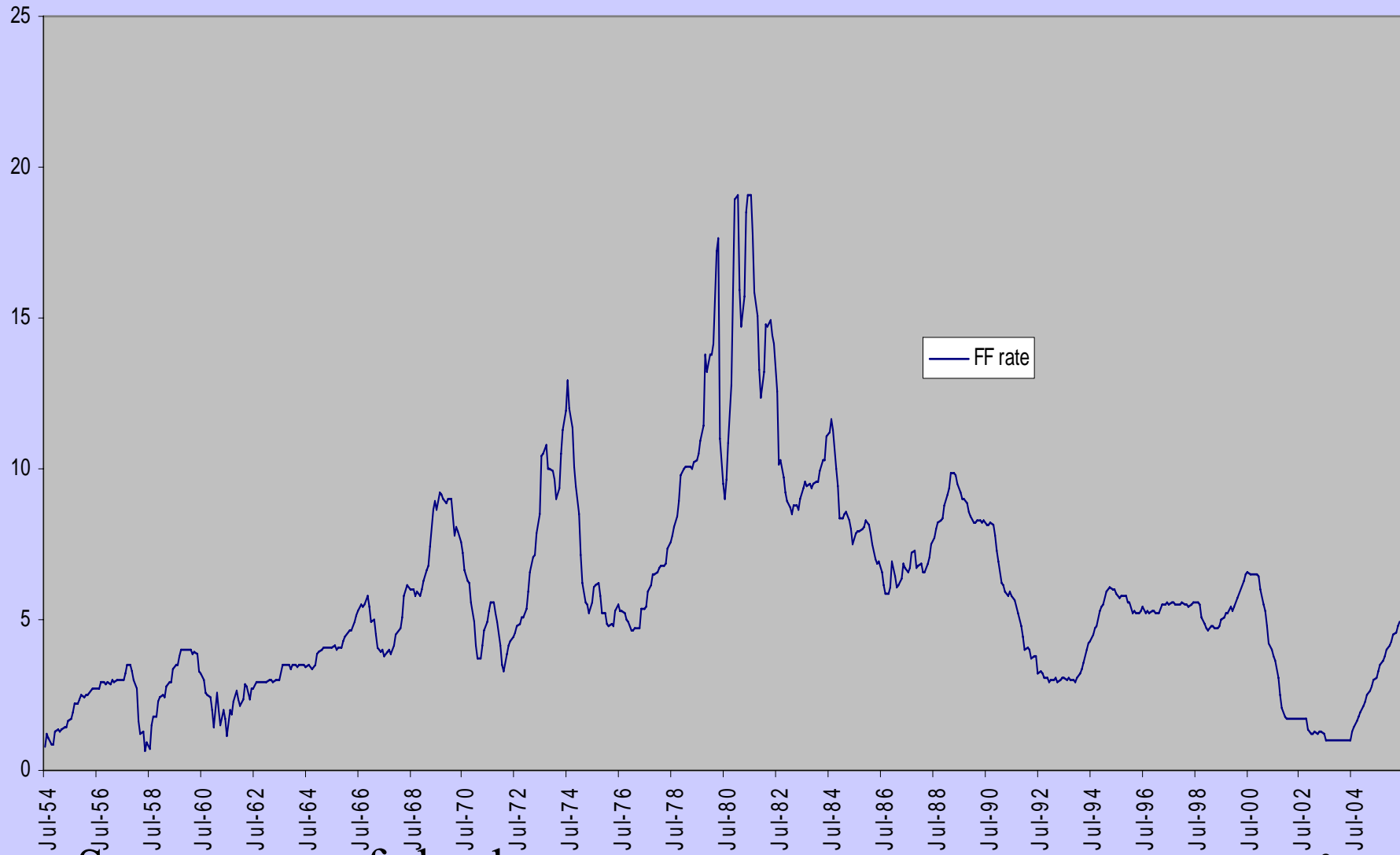
Keshab Bhattarai
Lecturer in Economics
Hull University Business School
HU6 7RX, Hull, UK

International Economic Policy Conference, Hong Kong
28-30 June 2006; www.ecomod.net

Bank of England Rate, Monthly Average Series, 1975-2006

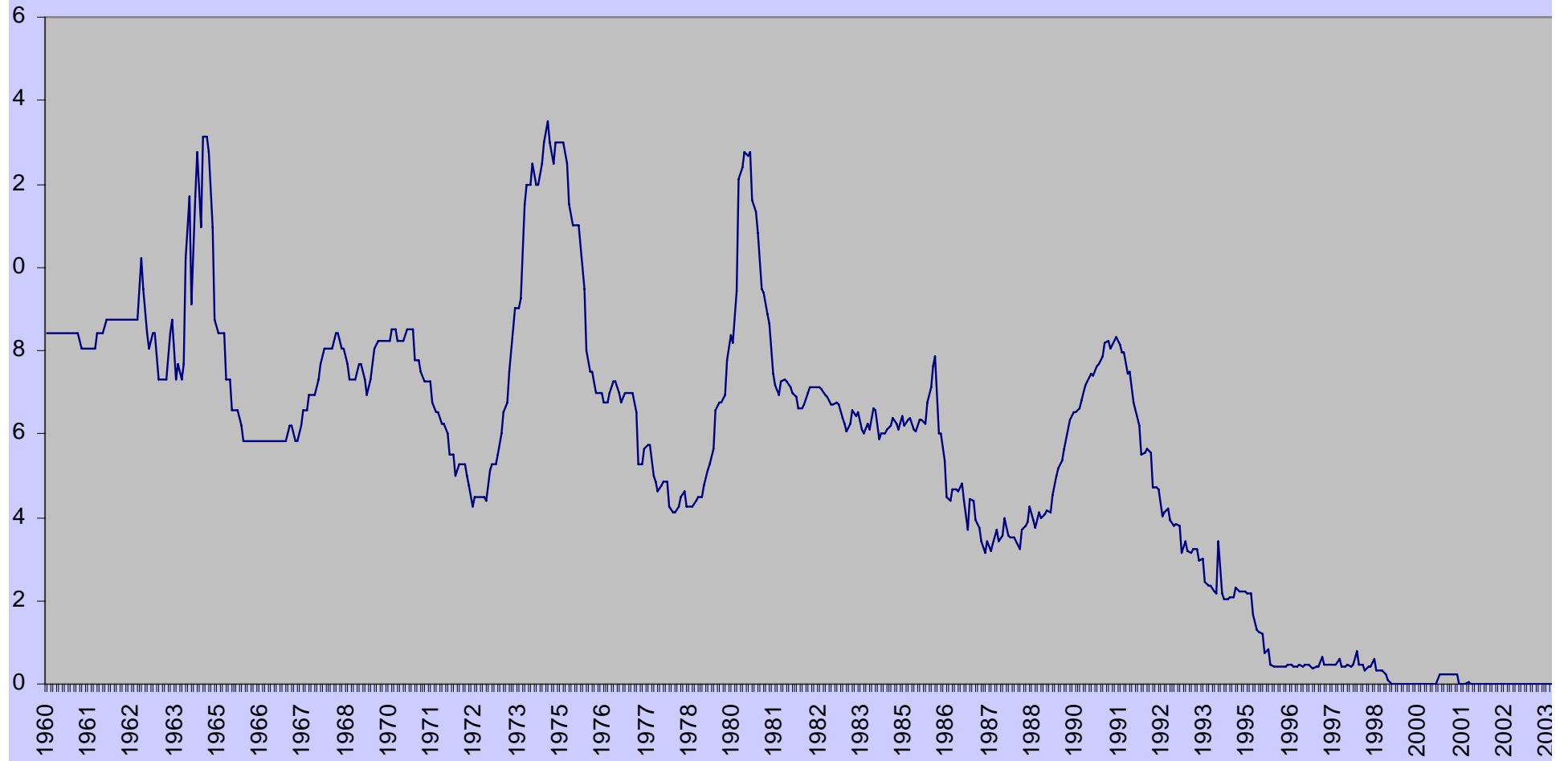


Federal Fund Rate, 1954-2006



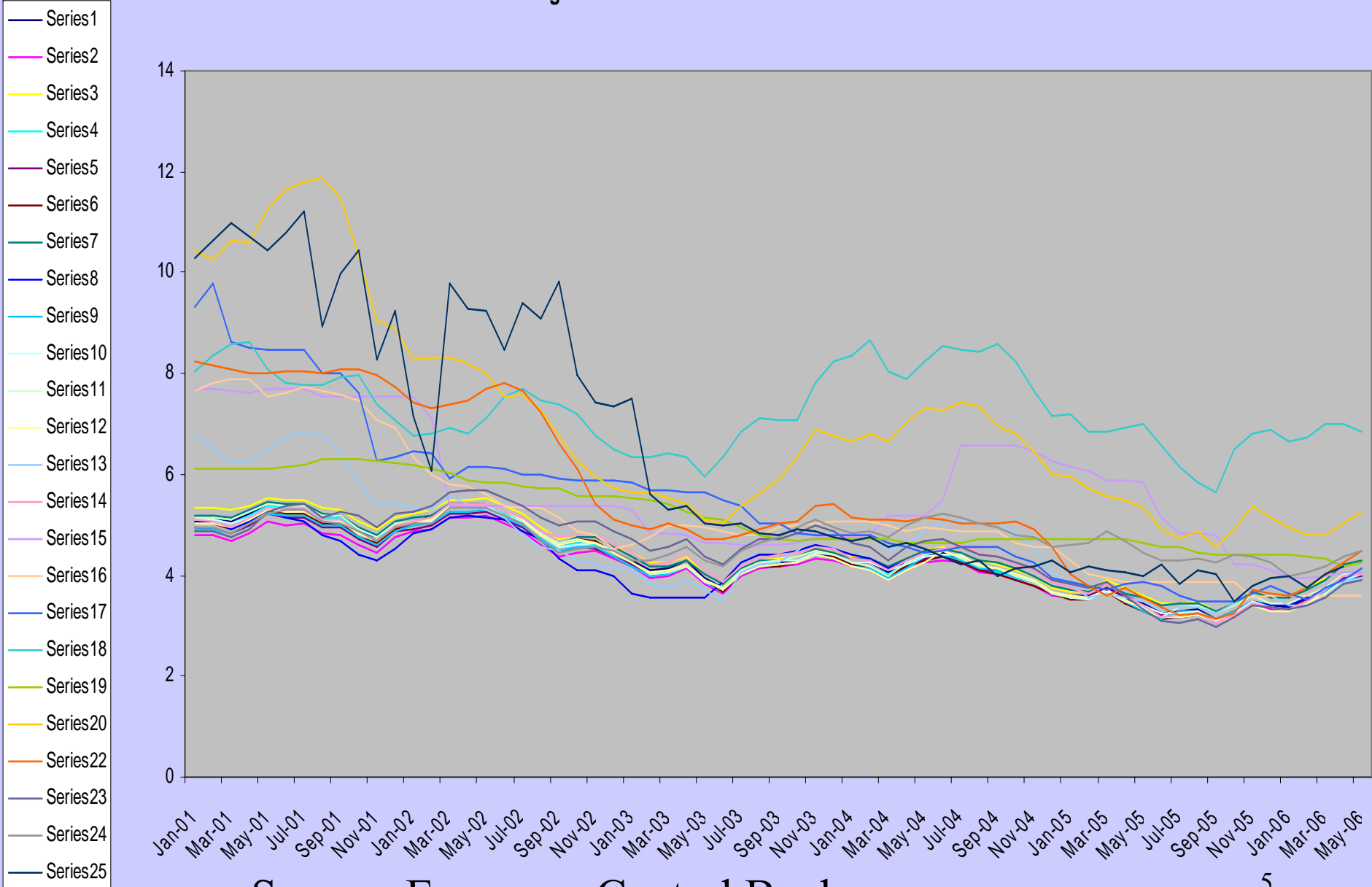
Source: www.federalreserve.gov

Monthly Interest Rate Series in Japan



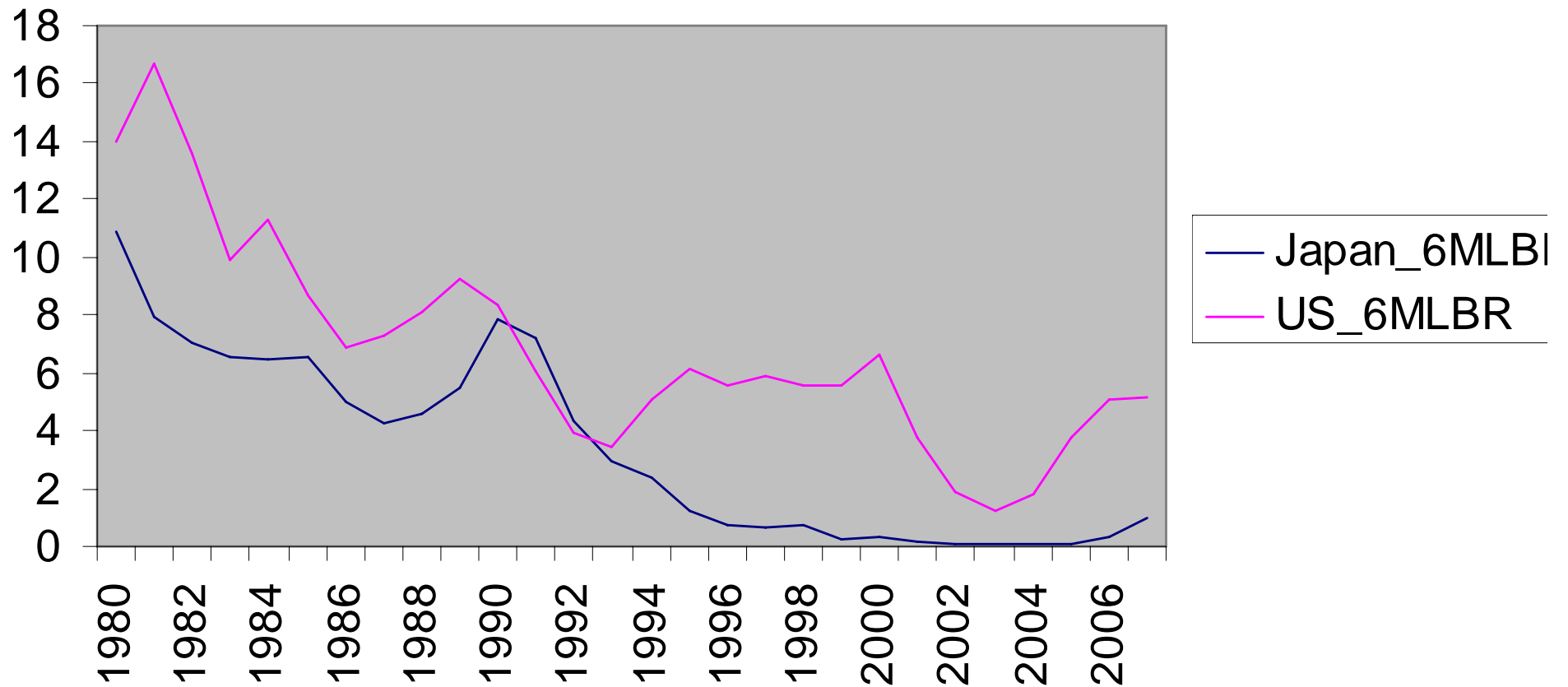
Source: Bank of Japan

Convergence of Interest Rate in EU economies



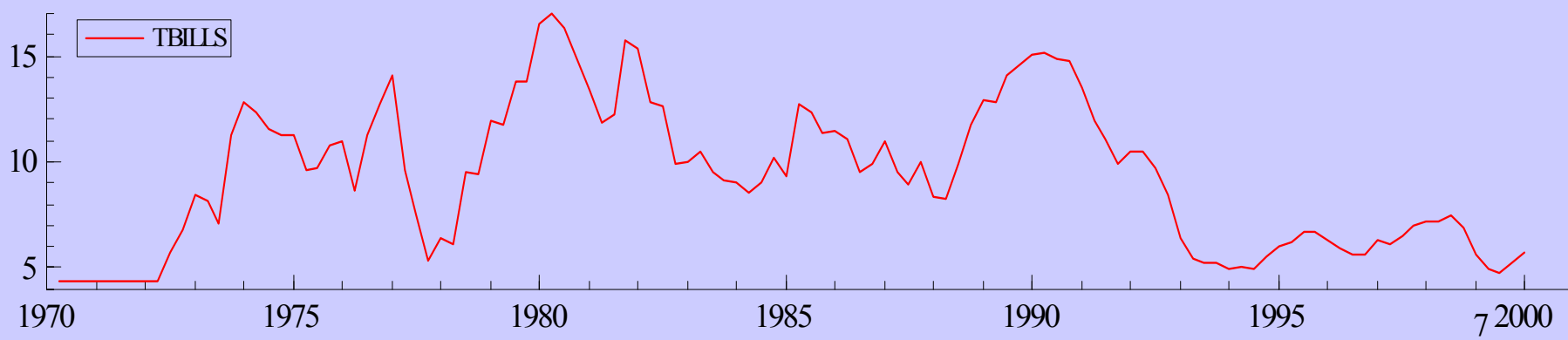
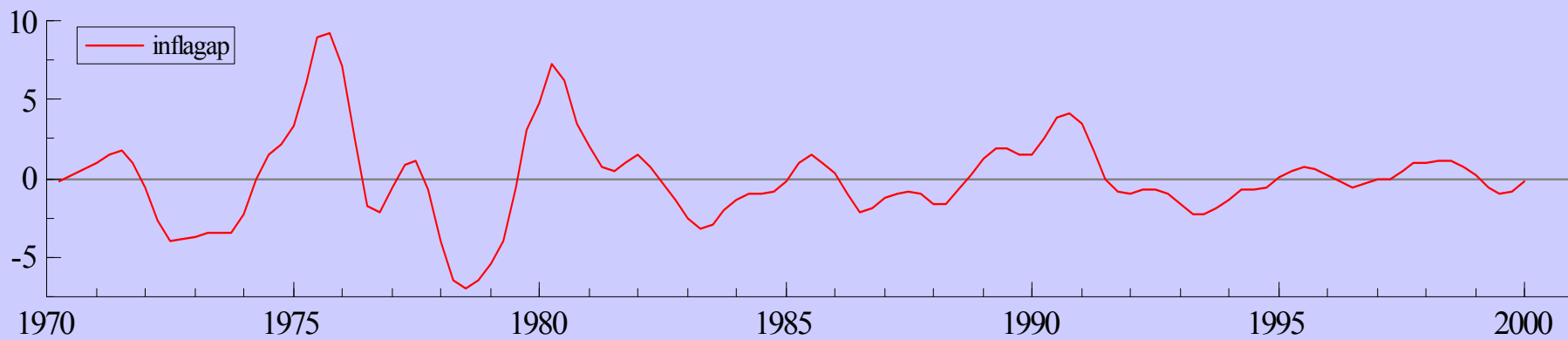
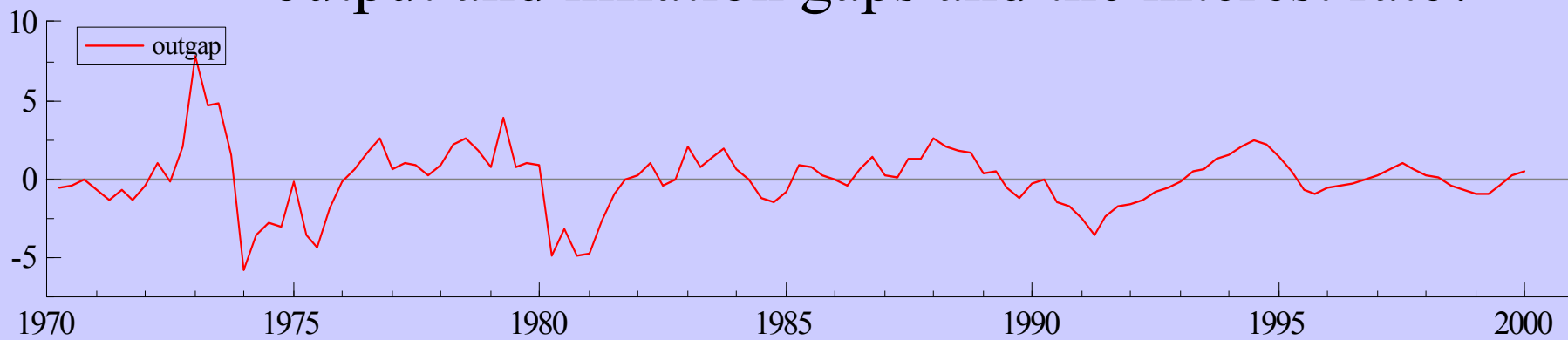
Source: European Central Bank.

LIBOR in Japan and the US

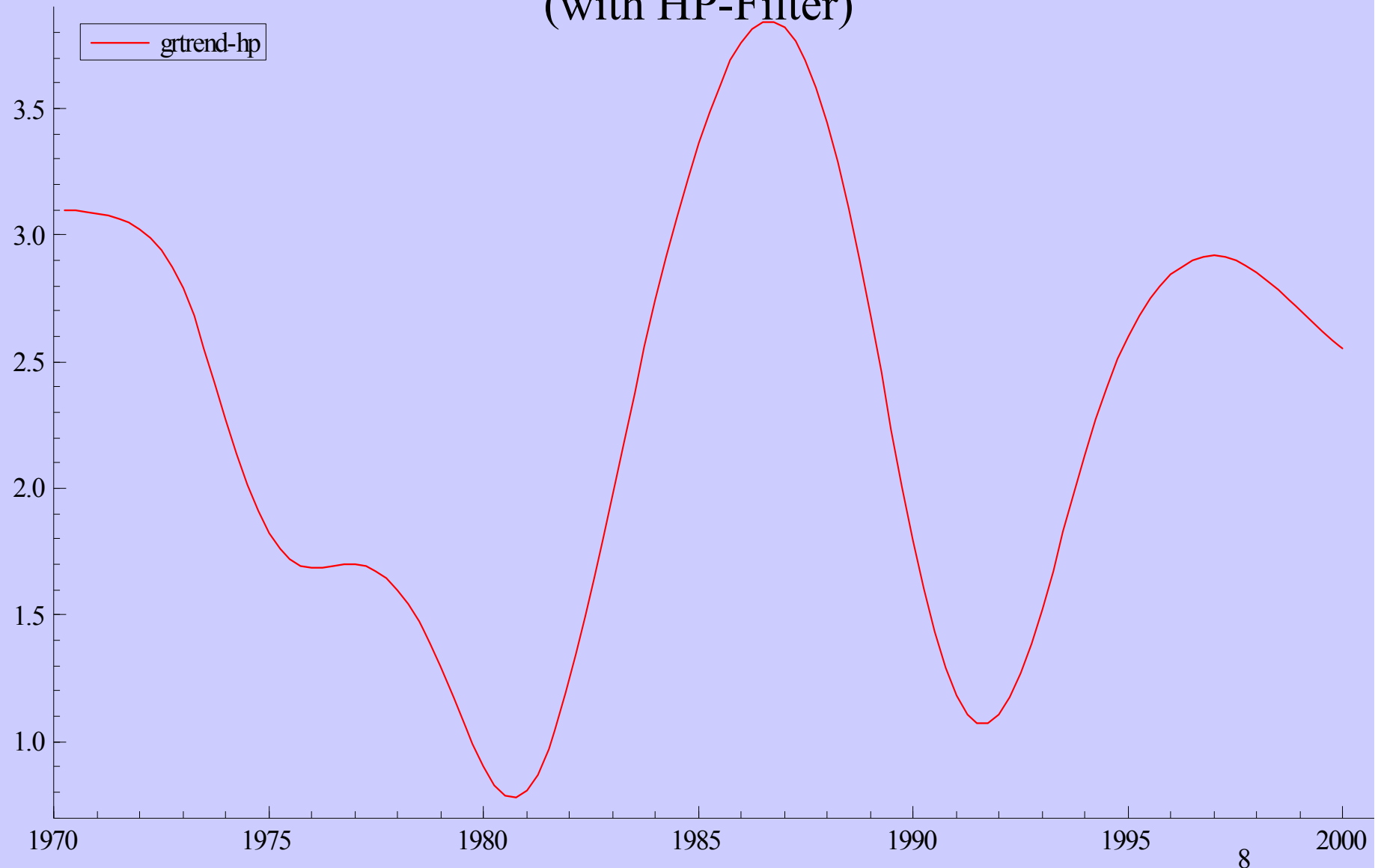


Source: World Economic Outlook, IMF.

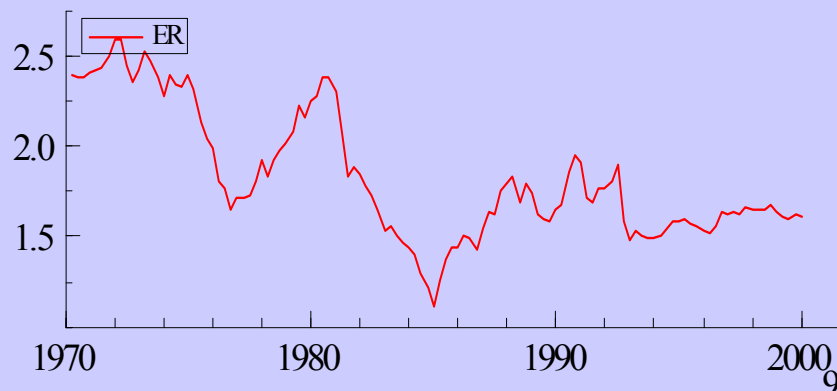
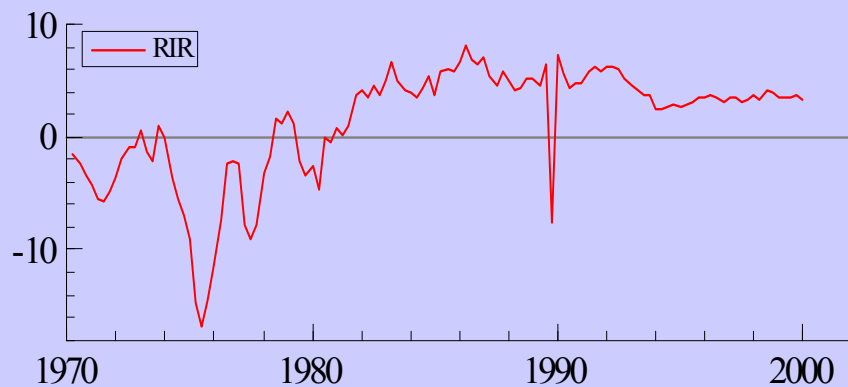
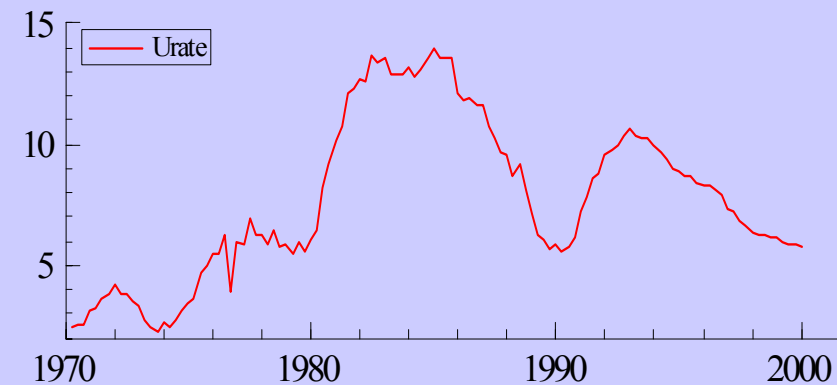
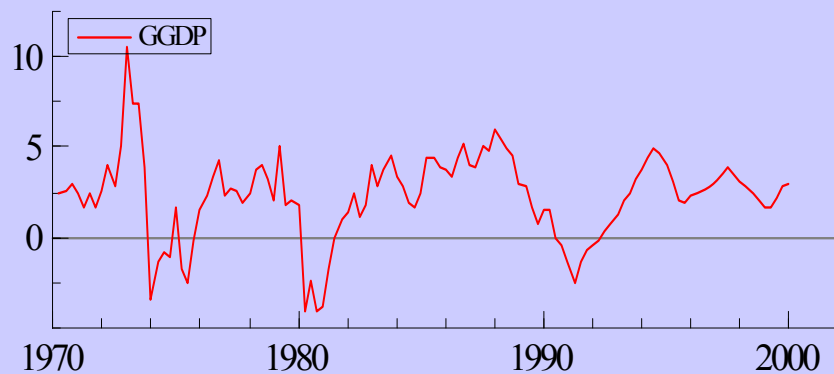
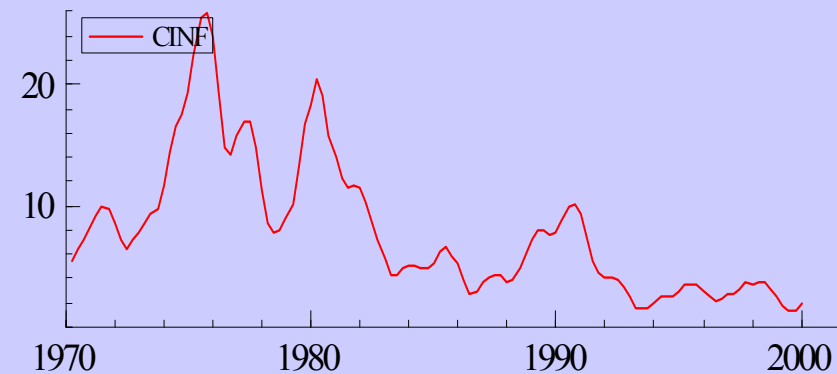
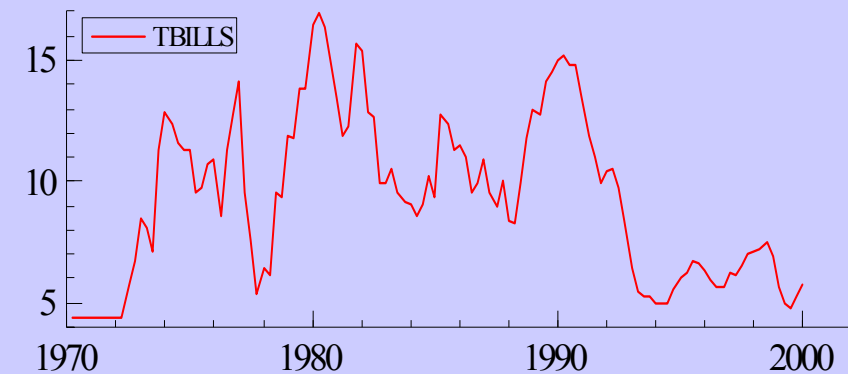
Question: Is there any systematic link between output and inflation gaps and the interest rate?



Does Changes in the interest remove fluctuations in output? Quarterly Trend Growth Rate in the UK:1970:2-2000:1 (with HP-Filter)

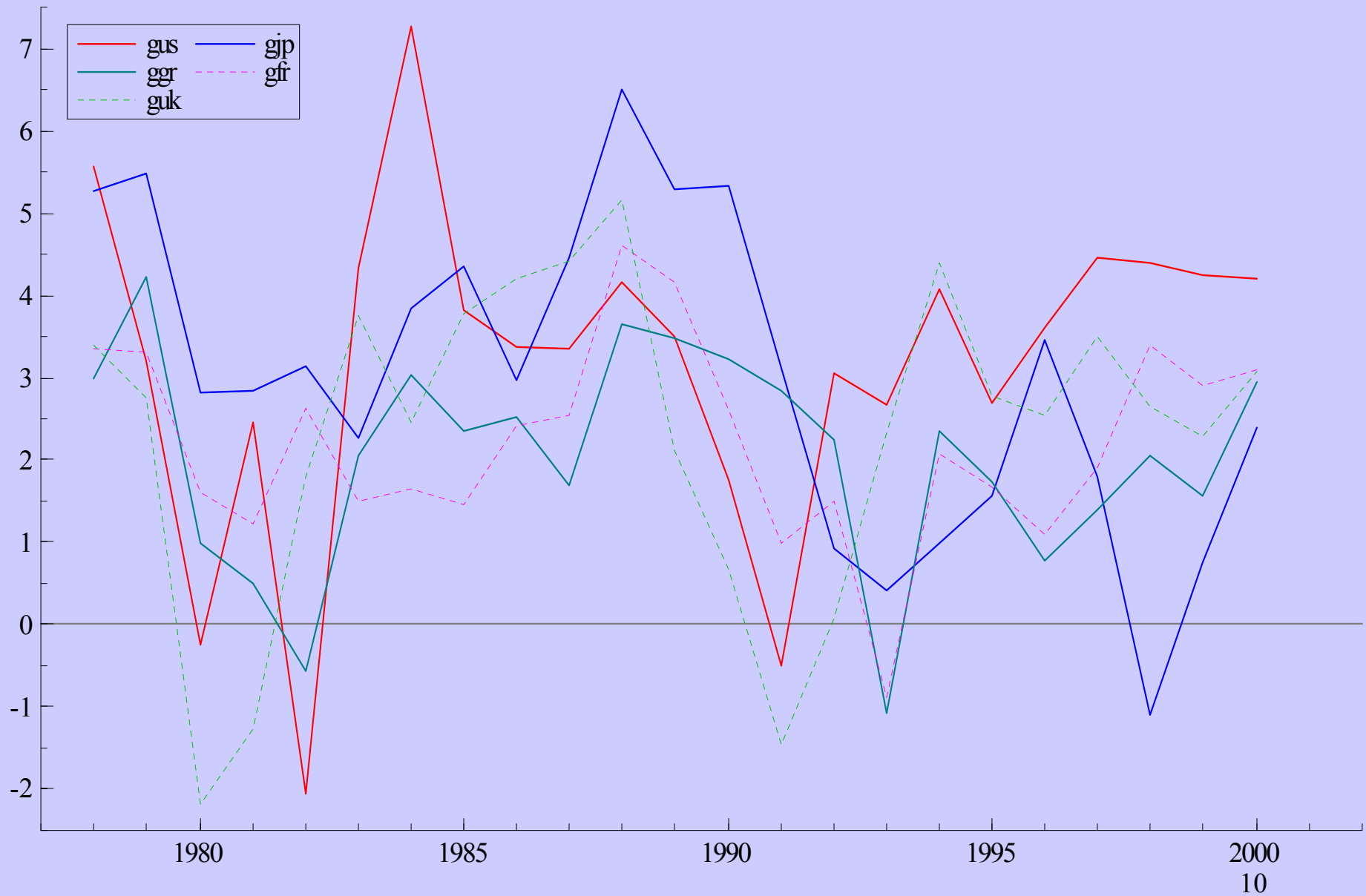


Interest Rate, Inflation, Growth Rate, Unemployment and Exchange Rate in the UK 1970:2-2000:1

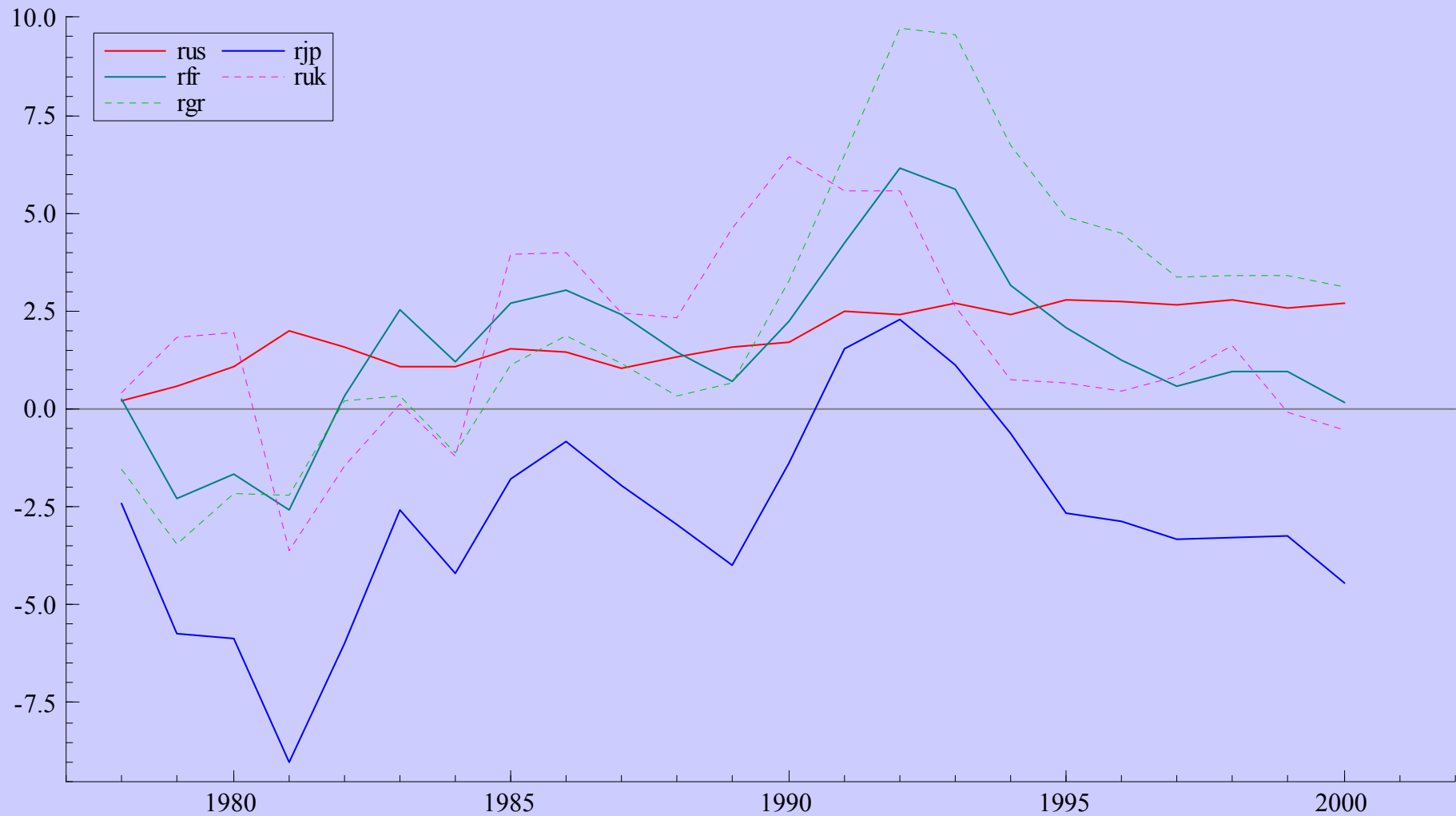


Source: Office of National Statistics. Navidata

Growth Rate of Output in Germany, France, Japan, UK and the US

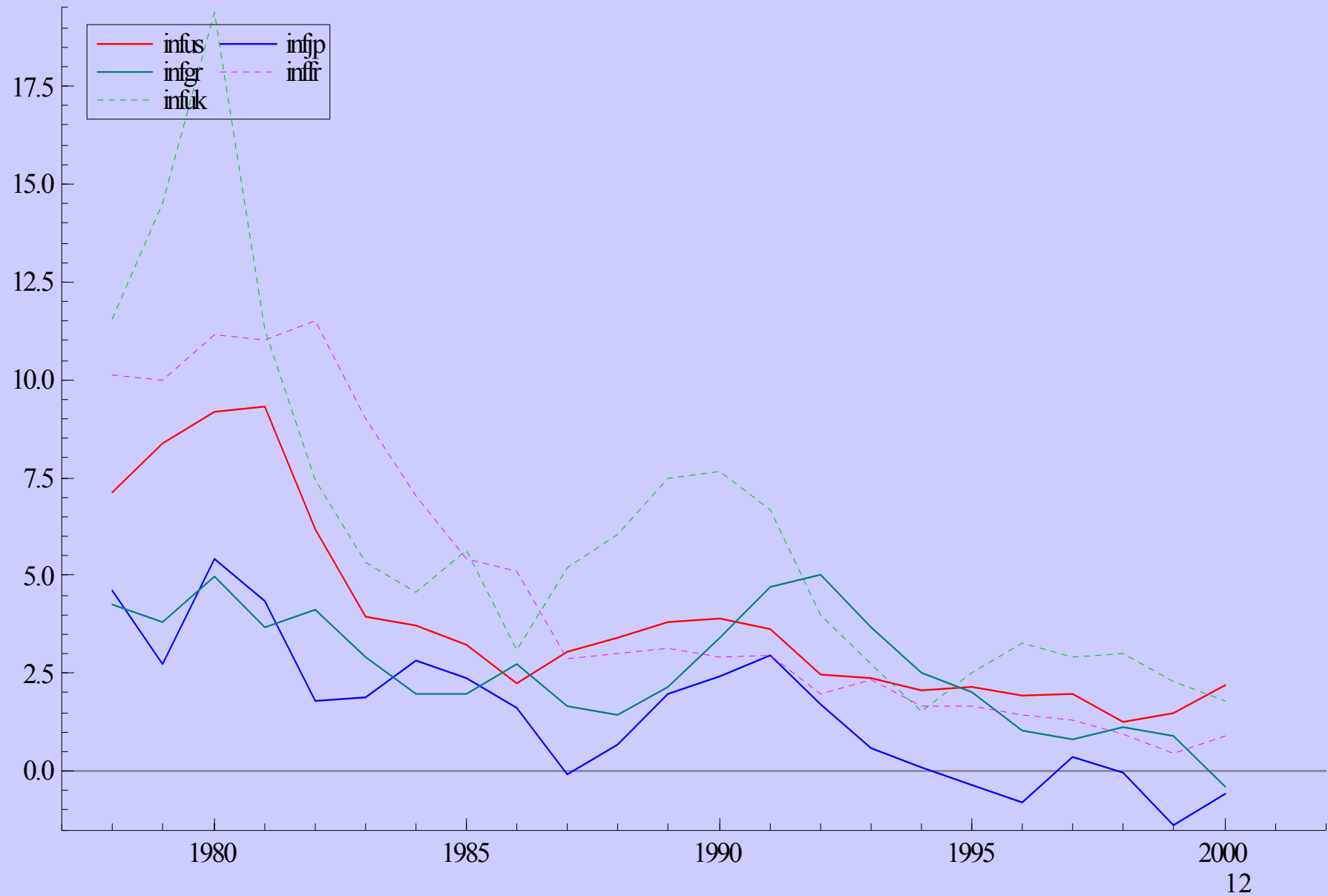


Real Interest Rate in Germany, France, Japan, UK and the US



Source: World Bank CD Database

Inflation Rate in Germany, France, Japan, UK and the US



Background Literature

General Literature on Role of Money in the Economy

Keynes (1936), Hicks (1937), Bailey(1956) Phillips (1958), Friedman (1968), Phelps (1968),Tobin (1969)) Taylor (1972). Taylor (1993), Laidler and Parkin (1975) Kydland and Prescott (1977), Phelps and Taylor (1977) Aghevli (1977), Gordon (1983), Barro and Gordon (1983), Sargent (1986) Goodhart (1989), Nickell (1990), Buiter and Patel (1992), Ball and Romer (1990) Dornbusch (1992), MPC (1999), Lockwood Miller and Zhang (1998), MPC (1999).

Natural Rate of Unemployment Hypothesis

Friedman (1968), Phelps (1968)

Research in Time Inconsistency, Policy Co-ordination and

Time inconsistency

Kydland and Prescott (1977), Phelps and Taylor (1977),
Gordon (1983), Barro and Gordon (1983)

Lockwood Miller and Zhang (1998), Rogoff (1985), Miller
and Salmon (1985)),

Policy Co-ordination at National and International Level

Krugman (1979), Barro and Gordon (1983), Canzoneri M.
B. and J A Gray (1985), Cukierman (1994), Goodhart
(1994), Nardhaus (1994) Eijffinger SCW and J.D. Haan
(2000)

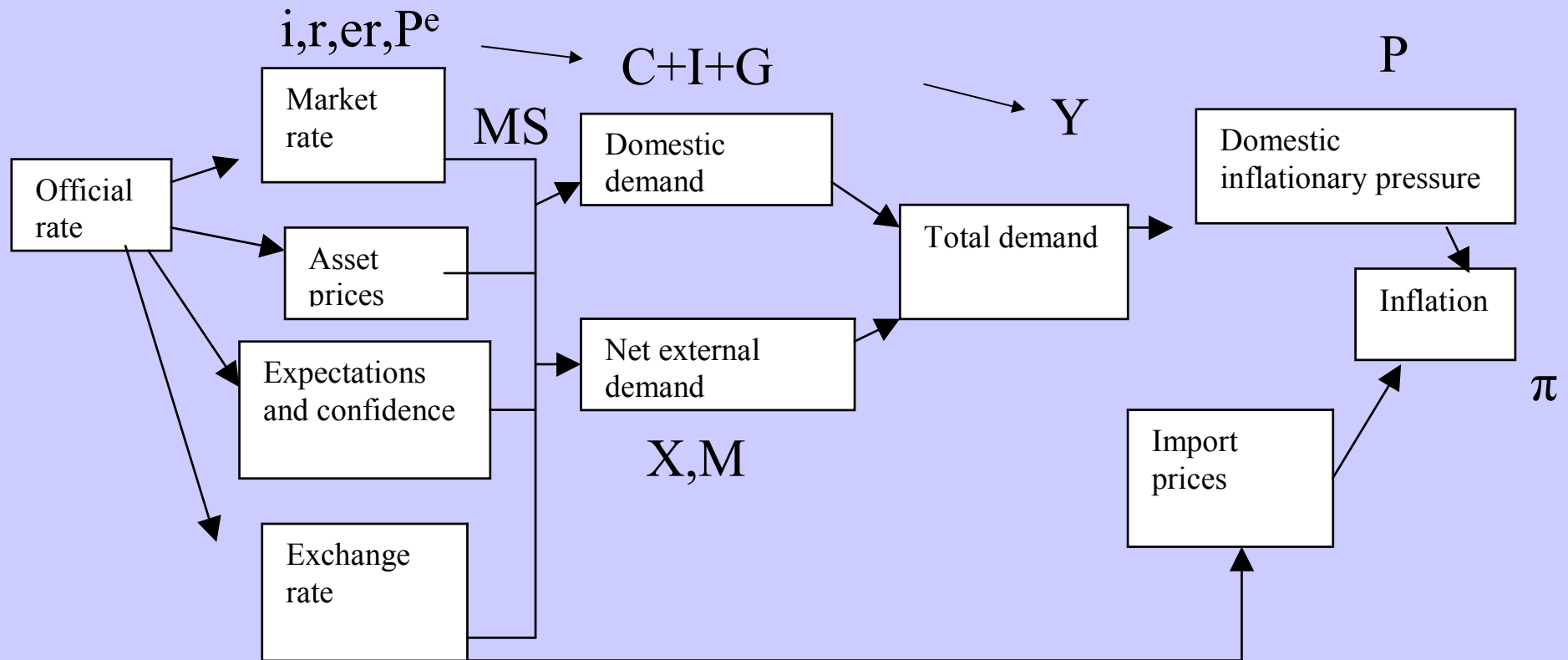
Money in General Equilibrium

Tobin (1969) Altig D E, C.T. Carlstrom and K.L. Lansing
(1995), Lockwood Miller and Zhang (1998), Holly and
Weale (2000), Corsetti and Pesenti (2001), Benigno(2002)

Summary of recent applied studies on the determination and interdependence in the interest rates and their impact among economies

Authors	Economic issues	Method	Summary	Journal
Asimakopoulou, Goddard and Siriopoulos(2000)	US and major European equity markets	spectral analysis	Lead-lag relation in stock returns in EU and US	AE
Bacchetta and Ballabriga(2000)	The impact of monetary policy and banks' balance sheets: some international evidence.	VAR	Strong relation between the Interest and output in the US and 13 EU economies	AFE
Brooks and Skinner(2000)	What will be the risk-free rate and benchmark yield curve following European monetary union?	Linear factor model	UK 3-month yield curve best approximates others in EU	AFE
Berument and Jelashi (2002)	Fisher hypothesis a multi-country analysis	ADF, OLS, ARCH-LM	Support for Fisher hypothesis for 13 of 26 countries	AE
Mills and Wood (2002)	Wages and prices in the UK	VECM	Wage growth does not predict inflation	AE
Silvapulle and Hewarathna (2002)	Robust estimation and inflation forecasting	ECM	Support Fisher effect on inflation for Australia	AE
Camarero, Ordonez and Tamarit (2002)	Monetary transmission in Spain	S-CVAR	Support for endogenous policy reaction of monetary policy	AE
Cheung and Westerman (2002)	Output dynamics in G7 countries: stochastic trends and cyclical movements	VAR-Co integration	Existence of common business cycles among G7 countries	AE
Lee (2002)	Real interest rate in regional economic blocks,	VEC, ARIMA	Long run relation in real interest rates of APEC, EU and the US	AE
Castelnouvo (2003)	Taylor rules, omitted variables, and the interest rate smoothing in the US	OLS in first differences	Test of forward looking Taylor rule in the US	EL
Yamada (2002)	Real interest rate equalisation: some evidence from three major world financial markets	VAR cointegration	Departure from long-run real interest rate equalisation is not very large	AE
Ferris and Galbraith(2003)	Indirect convertibility as a money rule for inflation targeting	Relative price concept	How indirect convertibility brings price stability(fixing a basket/ unit of money)	AFE
Valente (2003)	Monetary policy rules and regime shifts	MS-VAR	Time varying parameter and Markov Switching VAR model for policy rule	AFE
Ghazali and Ramlee (2003)	A long memory test of the long-run Fisher effect in the G7 countries	ARIMA, ARFIMA	Long run relation between interest rate and inflation in G7 countries.	.AFE
Wetherilt (2003)	Money market operations and short-term interest rate volatility in the United Kingdom	GARCH and VECM	Reduction in the volatility of market rates along with that in repo rates in uk	AFE
Buch (2004)	Cross-border banking and transmission mechanisms in Europe: evidence from German data.	Credit data analysis	Activities of commercial banks cause transmission of shocks across countries	AFE
Staikouras(2004)	The information content of interest rate futures and time-varying risk premia	VAR cointegration	Tests speculative efficiency hypothesis and supports price discovery hypothesis	AFE
Butter and Jenson (2004)	An empirical analysis of German long term interest rate	ARIMA, ECM	Four theories of interest rate explain German short term rate	AFE
Gerlack-Kristen (2005)	Too little too late, interest rate setting and the cost of consensus	Vote and simulation	Majority vote better than consensus in setting policy	EL

Bank of England's View on Transmission Mechanisms of Monetary Policy: How Does Money Supply Affect the Price Level?



Two Conditions to have real effect of Monetary policy

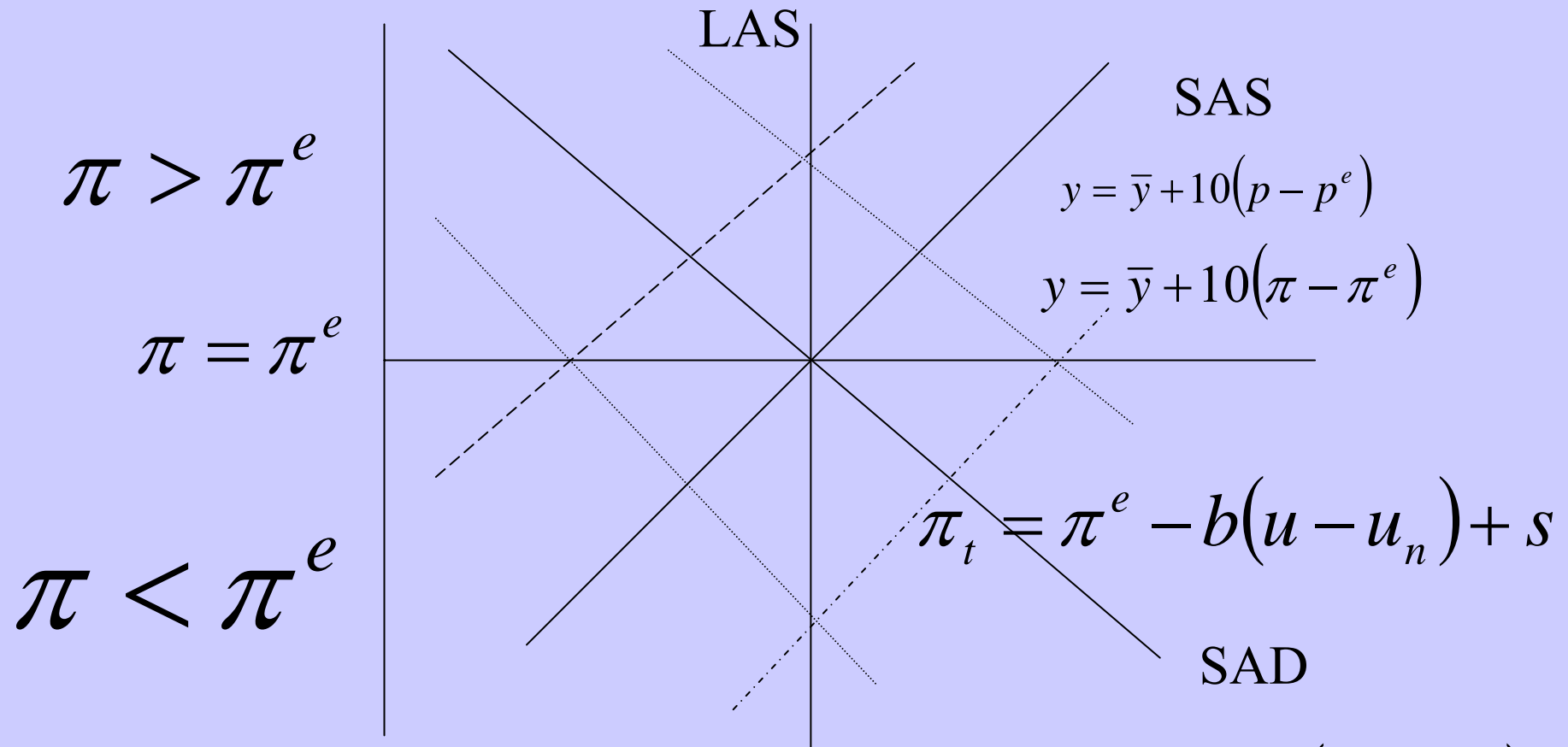
Central bank controls monetary base $M1 = R + Cu$

Prices do not adjust instantaneously

$$M \uparrow i, r \downarrow C, I, X, G \uparrow Y \uparrow P \uparrow \pi \uparrow \frac{M}{P} \downarrow i, r \uparrow$$

First, second and third round effects: 24 months to have full effect

Aggregate Supply, Inflation and natural rate of unemployment hypothesis



Summary:

	0					
		$y < \bar{y}$	$y = \bar{y}$	$y > \bar{y}$		$(u - u_n)$
$\pi_t > \pi_t^e \Rightarrow$	$u_t < u_N \Rightarrow$					
$\pi_t < \pi_t^e \Rightarrow$	$u_t > u_N \Rightarrow$	$u > u_n$	$u = u_n$	$u < u_n$		
$\pi_t = \pi_t^e \Rightarrow$	$u_t = u_N \Rightarrow$					

Main Points on Interest Determination Rule

- Higher interest rate is contractionary. Full effect of interest rate changes in output is felt after many lags, 2 years.
- The price level rises when the output is above the trend, raise the interest rate to stabilise prices and remove inflationary pressure.
- Lead and lag relation: Increase in the output at the current period may raise the rate of inflation in the next period (Aggregate supply curve).
- Higher rate of interest lowers the rate of inflation by reducing the aggregate demand in boom period and the lower interest rate raises it in the slump.
- Interest rates should be determined based on economic facts (output and inflation gaps) but not according to whims of the policy makers by an independent central bank.

Three Equations of the Interest Determination Rule: Taylor Rule

$$y_t - y_t^* = -d(i_{t-1} - i_{t-1}^*) \quad d > 0 \quad (1)$$

where i_t and i_t^* are actual and natural level of output, i_t is the actual rate of interest in period t , i is the interest target of the monetary authority.

One period lag is assumed between the interest rate decision and the change in the output.

$$\pi_t = \pi_t^* + c(y_{t-1} - y_{t-1}^*) \quad c > 0 \quad (2)$$

where π_t and π_t^* are actual and target inflation rates.

$$i_t = i_t^* + a(y_t - y_t^*) + b(\pi_t - \pi_t^*) \quad a > 0; b > 0 \quad (3)$$

Reduced Form Equation of the Interest Determination Model

$$i_t = i_t^* - ad(i_{t-1} - i_{t-1}^*) - bcd(i_{t-2} - i_{t-2}^*)$$

$$i_t + adi_{t-1} + bcdi_{t-2} = i_t^* + adi_{t-1}^* + bcdi_{t-2}^* \quad (4)$$

$$\beta_0 = (i_t^* + adi_{t-1}^* + bcdi_{t-2}^*), \text{ and } \beta_1 = ad \text{ and } \beta_2 = bcd.$$

$$\text{Reduced form: } i_t + \beta_1 i_{t-1} + \beta_2 i_{t-2} = \beta_0 \quad (5)$$

$$\text{Steady State: } i_t = i_{t+1} = i_{t+2} = \dots = i_{t+n} :$$

Natural rate of Interest: Steady State

Natural Rate of Interest: $\bar{i} = \frac{i_t^* + adi_{t-1}^* + bcdi_{t-2}^*}{1 + \beta_1 + \beta_2};$

$\bar{i} = \frac{i_t^* + adi_{t-1}^* + bcdi_{t-2}^*}{1 + ad + bcd}$ with flexible targets and

$\bar{i} = \frac{i_t^* + adi_t^* + bcdi_t^*}{1 + ad + bcd}$ with fixed targets (6)

General Solution of the Interest Rule Model

$$\lambda_1^t = \frac{-\beta_1 + \sqrt{\beta_1^2 - 4\beta_2}}{2} \quad \text{and} \quad \lambda_2^t = \frac{-\beta_1 - \sqrt{\beta_1^2 - 4\beta_2}}{2}.$$

$$i_t = A_1 \lambda_1^t + A_2 \lambda_2^t + \bar{i} \quad (7)$$

$$i_t = A_1 \left(\frac{-\beta_1 + \sqrt{\beta_1^2 - 4\beta_2}}{2} \right)^t + A_2 \left(\frac{-\beta_1 - \sqrt{\beta_1^2 - 4\beta_2}}{2} \right)^t + \bar{i} \quad (8)$$

$$i_t = A_1 \left(\frac{ad + \sqrt{(ad)^2 + 4bcd}}{2} \right)^t + A_2 \left(\frac{ad - \sqrt{(ad)^2 + 4bcd}}{2} \right)^t + \bar{i} \quad (9)$$

Convergence or Divergence from the Steady State

Reduced form:

$$i_t + \beta_1 i_{t-1} + \beta_2 i_{t-2} = 0 \quad (10)$$

- (a) real and distinct root if $\beta_1^2 - 4\beta_2 > 0$
- (b) real and equal roots case if $\beta_1^2 - 4\beta_2 = 0$
- (c) complex roots case if $\beta_1^2 - 4\beta_2 < 0$. The general solutions of the model in these three different cases are :

$$i_t = A_1 \lambda_1^t + A_2 \lambda_2^t + \bar{i} \quad (11)$$

$$i_t = i_t^* - ad(i_{t-1} - i_{t-1}^*) - bcd(i_{t-2} - i_{t-2}^*)$$

$$i_t = 1.630 + 0.582i_{t-1} + 0.244i_{t-2}$$

t-ratios (2.71) (6.42) (6.69)

r-square = 0.62 Durbin-Watson = 2.0104

Estimation of the Reduced Form Equation for Interest Rate

$$i_t = 9.446 - 0.183(y_t - y_t^*) + 0.370(\pi_t - \pi_t^*)$$

$$t \quad (32.2) \quad (-1.1) \quad (2.84)$$

$$(SE) \quad (0.29) \quad (0.13) \quad (0.181)$$

$$\text{Normality test: } \text{Chi}^2(2) = 11.279 [0.0036]**$$

Problems: Errors are not normal; Simultaneity bias.

Stationarity of variables in the model: UK quarterly data ADF tests (T=116, Constant; 5%=-2.89 1%=-3.49)

	Interest rate	Difference of Interest rate	Output gap	Inflation gap
Coefficient	-2.723	-6.463**	-6.160**	-7.428**
Lags	2	2	3	1

Simultaneous Equation Model of Interest Rate

$$y_t - y_t^* = d(i_{t-1} - i_{t-1}^*) + \varepsilon_{1,t}$$

$$\pi_t = \pi_t^* + c(y_{t-1} - y_{t-1}^*) + \varepsilon_{2,t}$$

$$i_t = i_t^* + a(y_t - y_t^*) + b(\pi_t - \pi_t^*) + \varepsilon_{3,t}$$

Interest rate: $i = 4.969(y - y^*) - 5.182(p - p^*)$
(7.74) (-7.27)

Output gap: $y - y^* = 0.08i + 0.504(p - p^*)$
(7.75) (5.21)

Inflation: $p - p^* = -0.071i + 0.421(y - y^*)$
(-7.27) (5.21)

System R-Square = 0.8637

Simultaneous Equation Model of Interest Rate

$$y_t - y_t^* = d(i_{t-1} - i_{t-1}^*) + \varepsilon_{1,t}$$

$$\pi_t = \pi_t^* + c(y_{t-1} - y_{t-1}^*) + \varepsilon_{2,t}$$

$$i_t = i_t^* + a(y_t - y_t^*) + b(\pi_t - \pi_t^*) + \varepsilon_{3,t}$$

$$AY_i + BX_i = U_i$$

$$Y_i = -A^{-1}BX_i + A^{-1}U_i$$

$$\hat{Y}_i = -A^{-1}BX_i$$

$$\text{Var}(Y_i - \hat{Y}_i) = A^{-2}\sigma_u^2$$

A simple Example of the Simultaneous Equation System

$$\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} \begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

$$\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} = \frac{1}{(a_{11}a_{22} - a_{12}a_{21})} \begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} + \frac{1}{(a_{11}a_{22} - a_{12}a_{21})} \begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix} \begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

$$y_{1i} = \frac{(a_{22}b_{11} - a_{12}b_{21})}{(a_{11}a_{22} - a_{12}a_{21})} x_{1i} + \frac{(a_{22}b_{12} - a_{12}b_{22})}{(a_{11}a_{22} - a_{12}a_{21})} x_{2i} + \frac{1}{(a_{11}a_{22} - a_{12}a_{21})} e_{1i}$$

$$y_{2i} = \frac{(-a_{21}b_{11} + a_{11}b_{21})}{(a_{11}a_{22} - a_{12}a_{21})} x_{1i} + \frac{(-a_{21}b_{12} + a_{11}b_{22})}{(a_{11}a_{22} - a_{12}a_{21})} x_{2i} + \frac{1}{(a_{11}a_{22} - a_{12}a_{21})} e_{2i}$$

Estimates of the Interest Rule model by FIML (using uk_r.xls by GiveWin PcGive): The estimation sample is: 1971 (1) to 2000 (1)

Equation for: TBILLS

	Coefficient	Std.Error	t-value	t-prob
TBILLS_1	0.938558	0.04090	22.9	0.000
GGDP_1	0.155536	0.05605	2.77	0.006
CINF_1	0.0321303	0.02456	1.31	0.193
Constant	U -0.0178904	0.4473	-0.0400	0.968

sigma = 1.2475

Equation for: GGDP

	Coefficient	Std.Error	t-value	t-prob
TBILLS_1	-0.124014	0.04638	-2.67	0.009
GGDP_1	0.689260	0.06356	10.8	0.000
CINF_1	-0.0269151	0.02785	-0.966	0.336
Constant	U 2.09479	0.5073	4.13	0.000

sigma = 1.41472

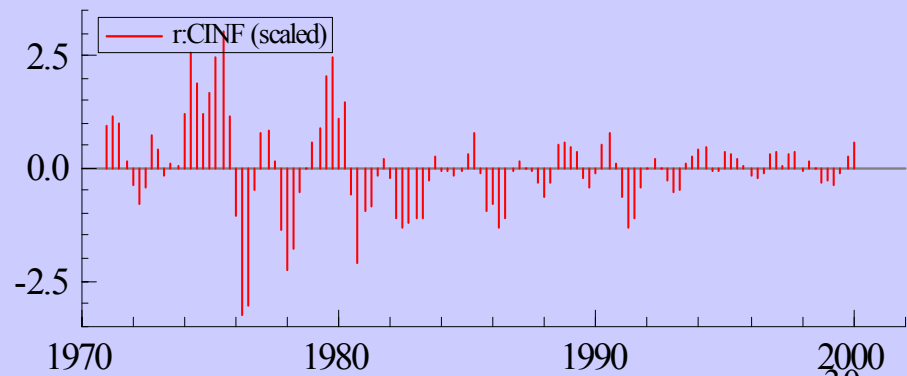
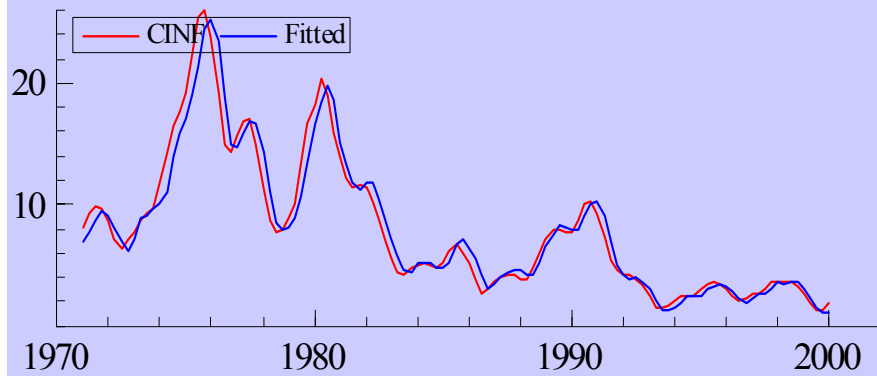
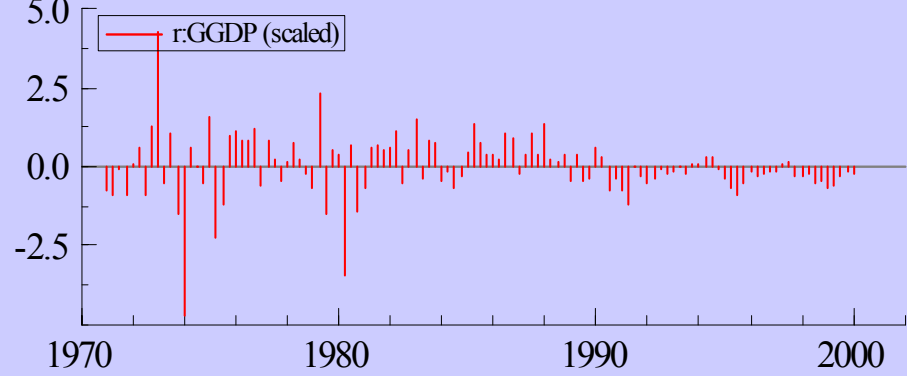
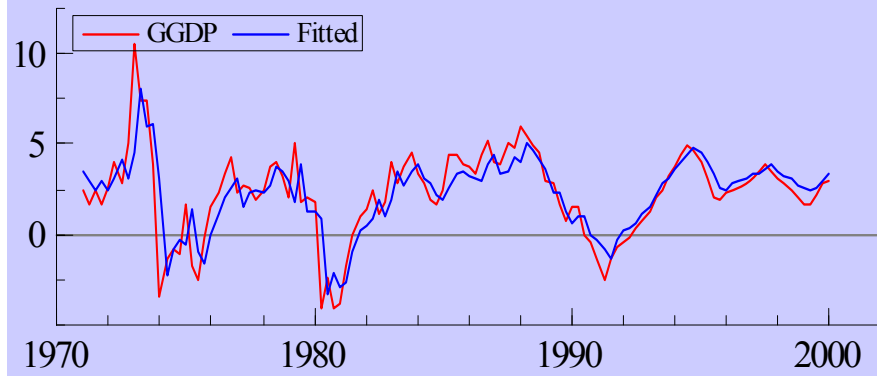
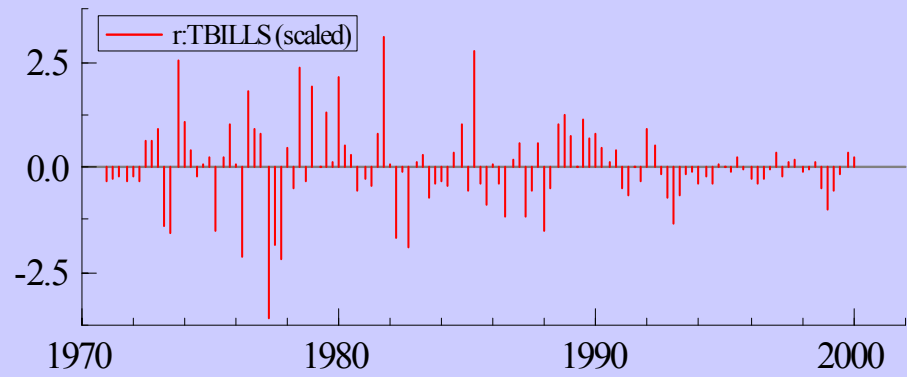
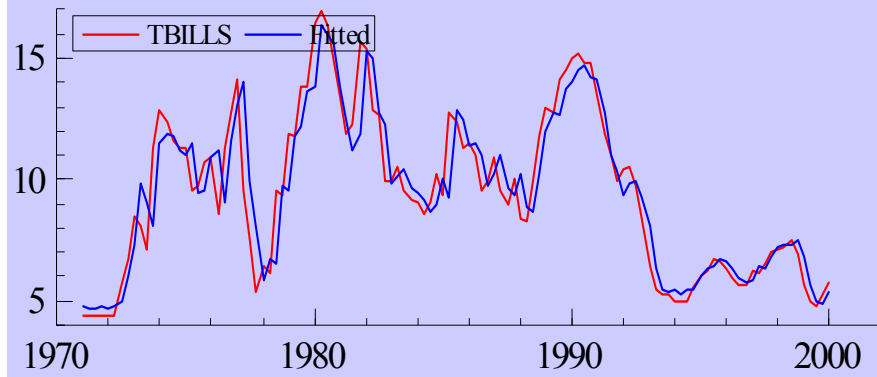
Equation for: CINF

	Coefficient	Std.Error	t-value	t-prob
TBILLS_1	0.0793641	0.04335	1.83	0.070
GGDP_1	0.133732	0.05941	2.25	0.026
CINF_1	0.979589	0.02603	37.6	0.000
Constant	U -0.936789	0.4741	-1.98	0.051

sigma = 1.32217

log-likelihood -586.063862 -T/2log|Omega| -88.0164366
 no. of observations 117 no. of parameters 12

Actual and Fitted Values for Interest Rate, Output and Inflation for UK



Test of Interest Determination Rule for Five Major Economies

	Output gap	Inflation gap	Constant	R ²
France	-6.641 (-14.778)	0.670 (1.341)	5.900 (1.341)	0.766
Germany	-10.732 (-15.187)	4.335 (4.953)	5.339 (11.898)	0.752
Japan	-6.775 (-6.554)	-1.794 (-7.061)	-1.312 (-3.487)	0.641
UK	-2.941 (-5.885)	1.006 (2.848)	7.416 (10.203)	0.574
USA	-1.794 (-7.061)	0.360 (0.408)	5.337 (18.955)	0.696

Pooled Estimation:

$$i_t = 6.25 - 0.29(y_t - y_t^*) + 0.115(\pi_t - \pi_t^*)$$

t-ratios (0.80) (-3.30) (1.33)

$$R^2 = 0.43$$

$$F = 5.5; N=100$$

Estimates of the Simultaneous Interest Rule model for UK and Four Major Industrial Economies

$$\begin{aligned}
 \text{rus} = & + 0.2507*\text{infus} + 0.04032*\text{infjp} - 0.1736*\text{infgr} - 0.1627*\text{inffr} \\
 (\text{SE}) & (0.103) \quad (0.102) \quad (0.0767) \quad (0.0489) \\
 & - 0.1207*\text{infuk} - 0.1136*\text{gus} - 0.1429*\text{gjp} - 0.004963*\text{ggr} \\
 & (0.0421) \quad (0.0518) \quad (0.049) \quad (0.0831) \\
 & - 0.07644*\text{gfr} - 0.08878*\text{guk} + 3.946 \\
 & (0.0798) \quad (0.065) \quad (0.316)
 \end{aligned}$$

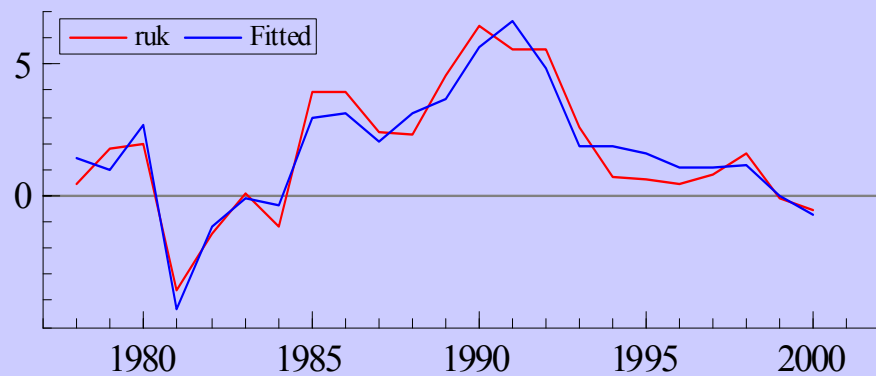
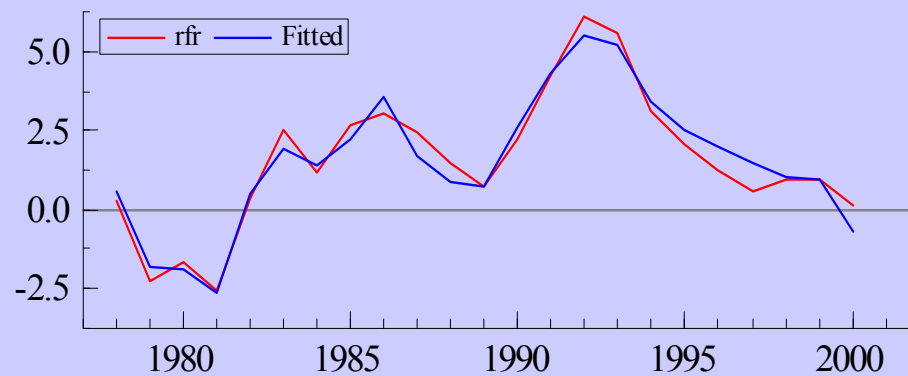
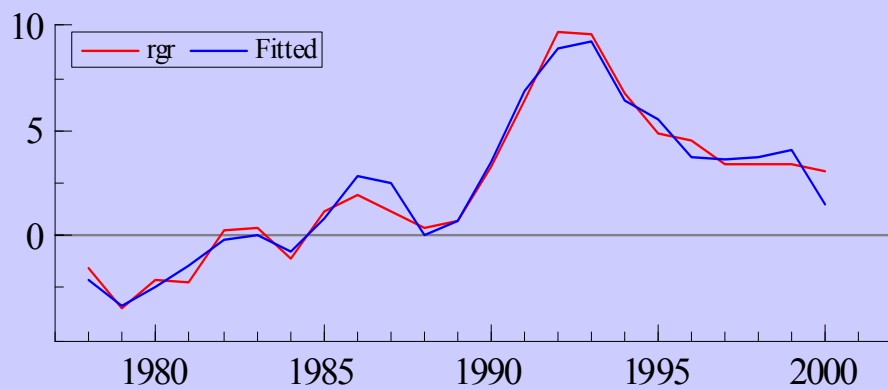
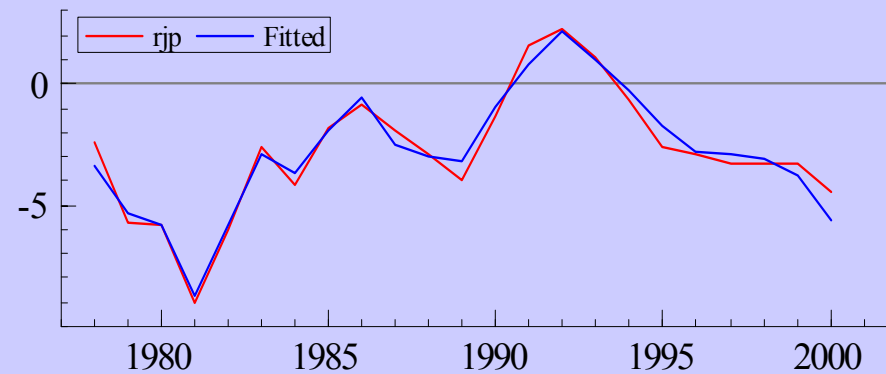
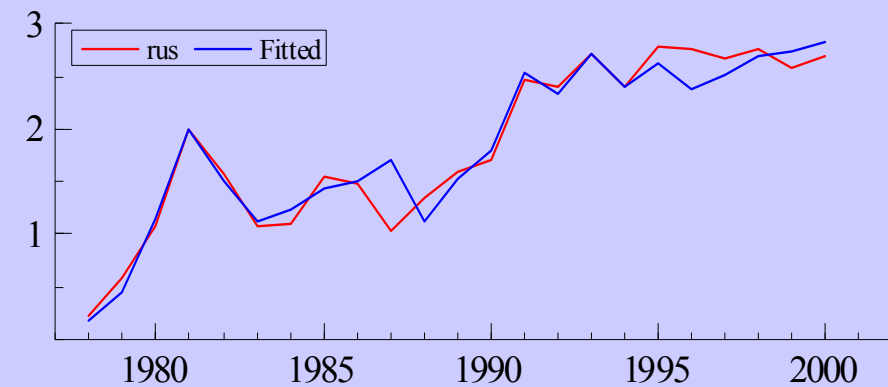
$$\begin{aligned}
 \text{rjp} = & - 0.9612*\text{infus} + 0.2619*\text{infjp} + 1.541*\text{infgr} - 0.3411*\text{inffr} \\
 (\text{SE}) & (0.278) \quad (0.276) \quad (0.207) \quad (0.132) \\
 & + 0.1209*\text{infuk} - 0.01156*\text{gus} + 0.1172*\text{gjp} + 0.2549*\text{ggr} \\
 & (0.114) \quad (0.14) \quad (0.132) \quad (0.224) \\
 & - 0.5457*\text{gfr} + 0.468*\text{guk} - 3.367 \\
 & (0.215) \quad (0.175) \quad (0.85)
 \end{aligned}$$

$$\begin{aligned}
 \text{rgr} = & + 0.2813*\text{infus} - 0.05551*\text{infjp} + 1.517*\text{infgr} - 0.8322*\text{inffr} \\
 (\text{SE}) & (0.34) \quad (0.337) \quad (0.252) \quad (0.161) \\
 & - 0.3356*\text{infuk} - 0.1166*\text{gus} - 0.2131*\text{gjp} - 0.1541*\text{ggr} \\
 & (0.139) \quad (0.17) \quad (0.161) \quad (0.274) \\
 & - 0.4911*\text{gfr} + 0.1629*\text{guk} + 5.319 \\
 & (0.263) \quad (0.214) \quad (1.04)
 \end{aligned}$$

$$\begin{aligned}
 \text{rfr} = & - 0.8201*\text{infus} + 0.1866*\text{infjp} + 1.228*\text{infgr} - 0.1101*\text{inffr} \\
 (\text{SE}) & (0.261) \quad (0.258) \quad (0.194) \quad (0.123) \\
 & - 0.09884*\text{infuk} + 0.009484*\text{gus} + 0.2115*\text{gjp} - 0.06226*\text{ggr} \\
 & (0.106) \quad (0.131) \quad (0.124) \quad (0.21) \\
 & - 0.3603*\text{gfr} + 0.2028*\text{guk} + 2.111 \\
 & (0.201) \quad (0.164) \quad (0.796)
 \end{aligned}$$

$$\begin{aligned}
 \text{ruk} = & - 1.394*\text{infus} + 0.6449*\text{infjp} + 0.8495*\text{infgr} - 0.3876*\text{inffr} \\
 (\text{SE}) & (0.405) \quad (0.401) \quad (0.301) \quad (0.192) \\
 & + 0.501*\text{infuk} - 0.4017*\text{gus} + 0.3004*\text{gjp} + 0.4134*\text{ggr} - 0.1568*\text{gfr} \\
 & (0.165) \quad (0.203) \quad (0.192) \quad (0.326) \quad (0.313) \\
 & + 0.2822*\text{guk} + 1.89 \\
 & (0.255) \quad (1.24)
 \end{aligned}$$

Actual and predicted values of interest Rate for UK and Four Major Industrial Country



Vector Autoregression Model for Analysing the Interest Rate Rule

$$Y_t = A_1 Y_{t-1} + \varepsilon_t$$

 Y_t

vector of variables
interest rate,
output gap
inflation gap

 ε_t

normally and identically distributed random error term

$$\Delta Y_t = (A_1 - I) Y_{t-1} + \varepsilon_t \quad \Pi = (A_1 - I)$$

$$\Delta Y_t = \Pi Y_{t-1} + \varepsilon_t$$

Decomposition of Long and Short Run Responses

Π

Long run response

$$\Pi = \alpha\beta'$$

α

Dynamic process of adjustment

β

Long run Steady State Relation

$$\Pi = \alpha\beta'$$

$$\Pi = \begin{bmatrix} -0.03654 & -0.12011 & 0.18569 \\ 0.02982 & -0.24185 & -0.08453 \\ -0.09433 & -0.07224 & -0.53655 \end{bmatrix}$$

$$\alpha = \begin{bmatrix} 0.01810 & 0.09100 & 0.01089 \\ 0.01667 & -0.00346 & -0.00208 \\ -0.00793 & -0.20723 & 0.00692 \end{bmatrix}$$

$$\beta = \begin{bmatrix} 1.0000 & 0.19498 & -6.6460 \\ -13.850 & 1.0000 & 3.6355 \\ -4.3680 & 2.7897 & 1.0000 \end{bmatrix}$$

Trace and Max Test for Cointegration Rank

$$\lambda_{trace(r)} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i)$$

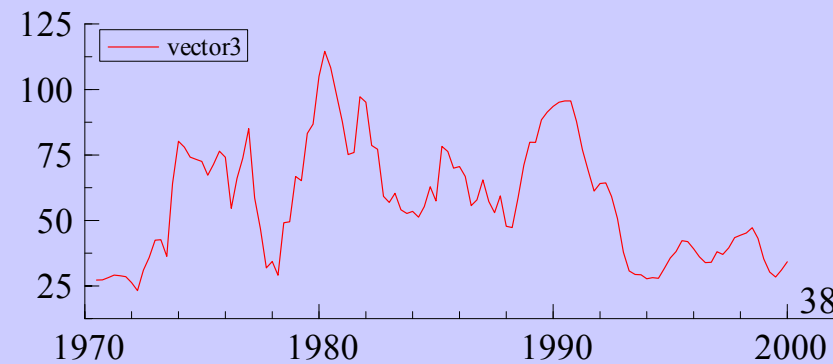
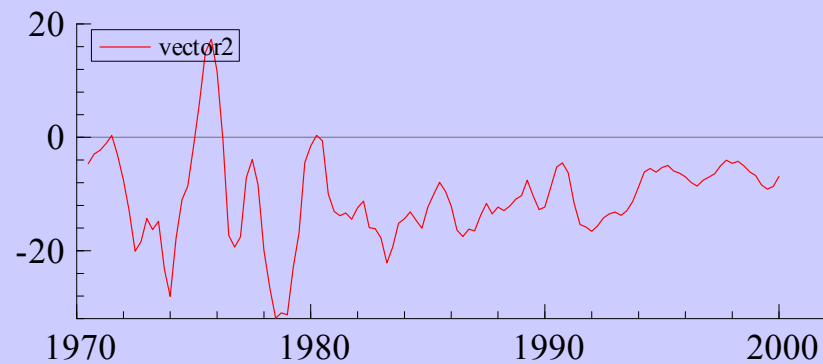
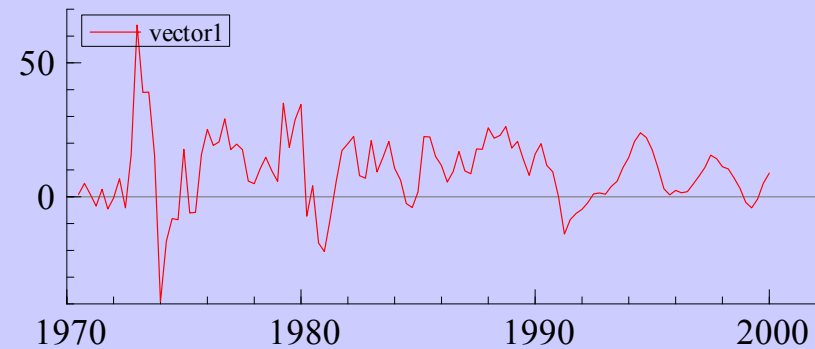
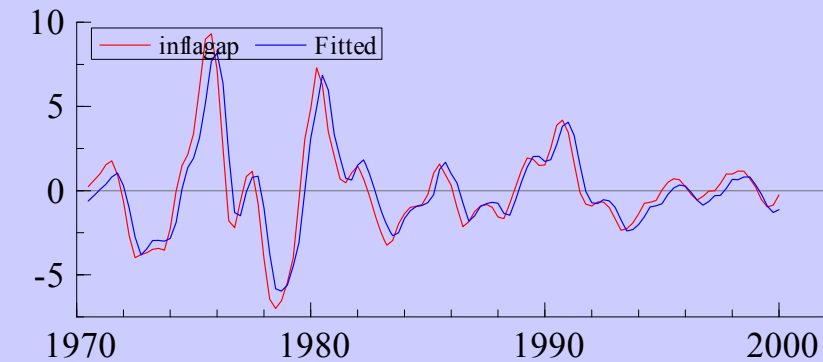
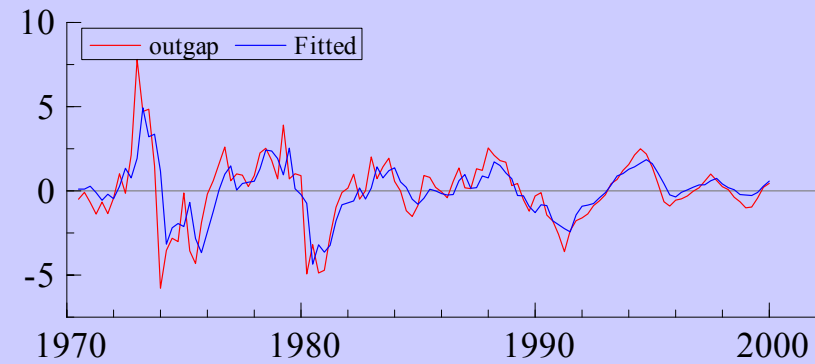
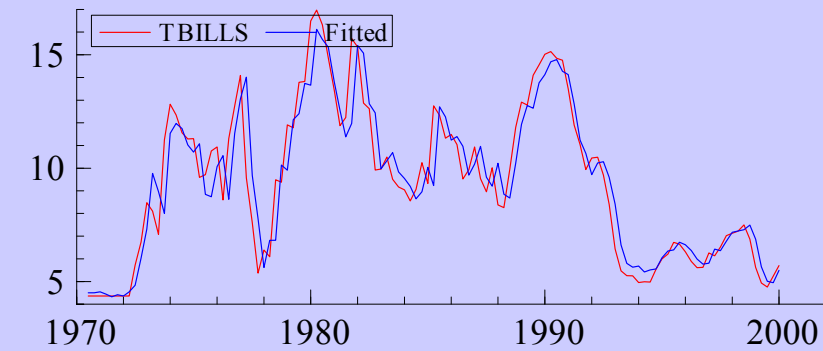
$$\lambda_{\max(r,r+1)} = -T \ln(1 - \hat{\lambda}_{r+1})$$

λ_i

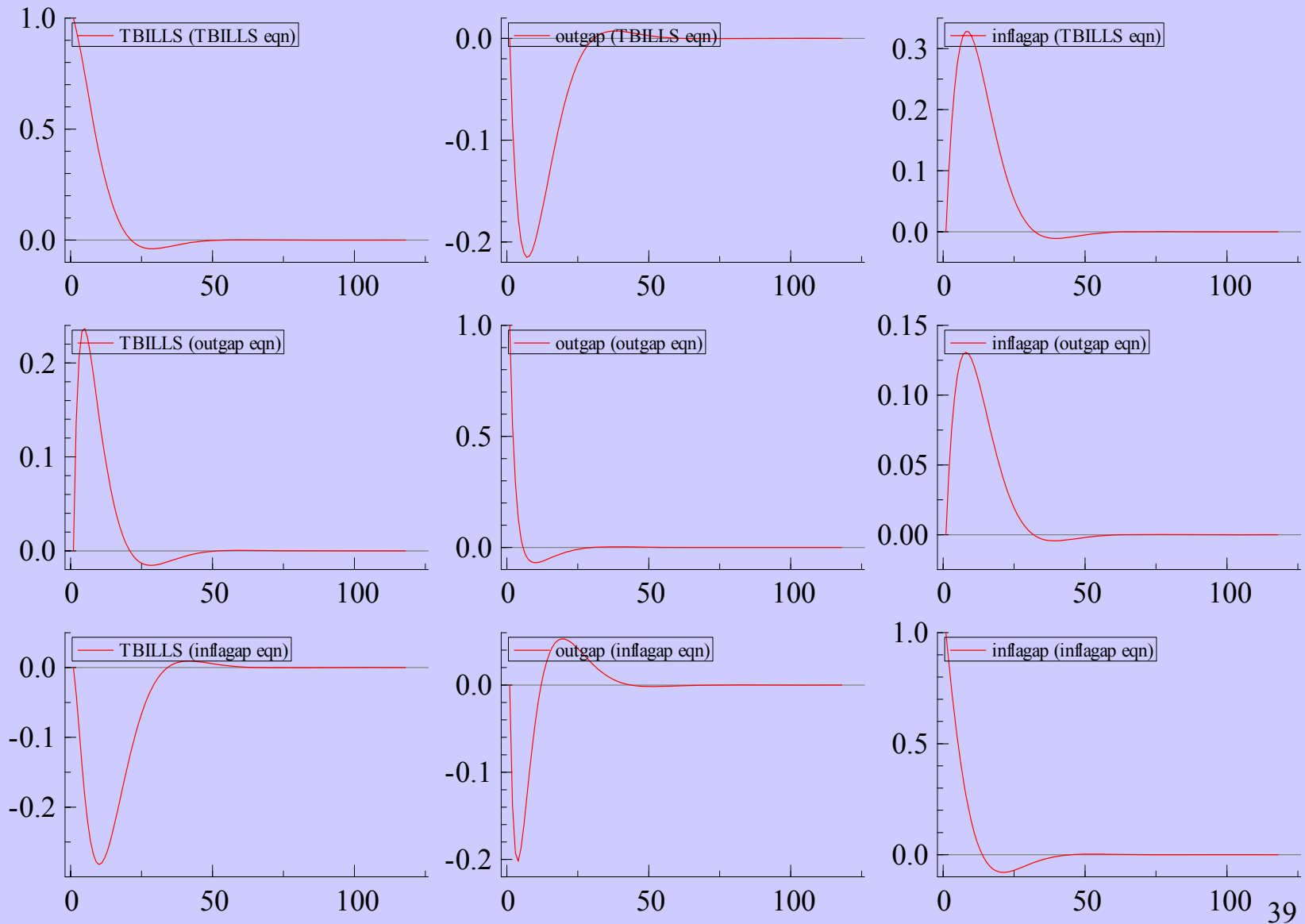
Eigenvalues of the characteristic matrix

rank	Trace test [Prob]	Max test [Prob]	Trace test (T-nm)	Max test (T-nm)
0	56.86 [0.000]**	34.38 [0.000]**	55.43 [0.000]**	33.52 [0.000]**
1	22.48 [0.003]**	12.68 [0.087]	21.91 [0.004]**	12.36 [0.097]
2	9.80 [0.002]**	9.80 [0.002]**	9.55 [0.002]**	9.55 [0.002]**

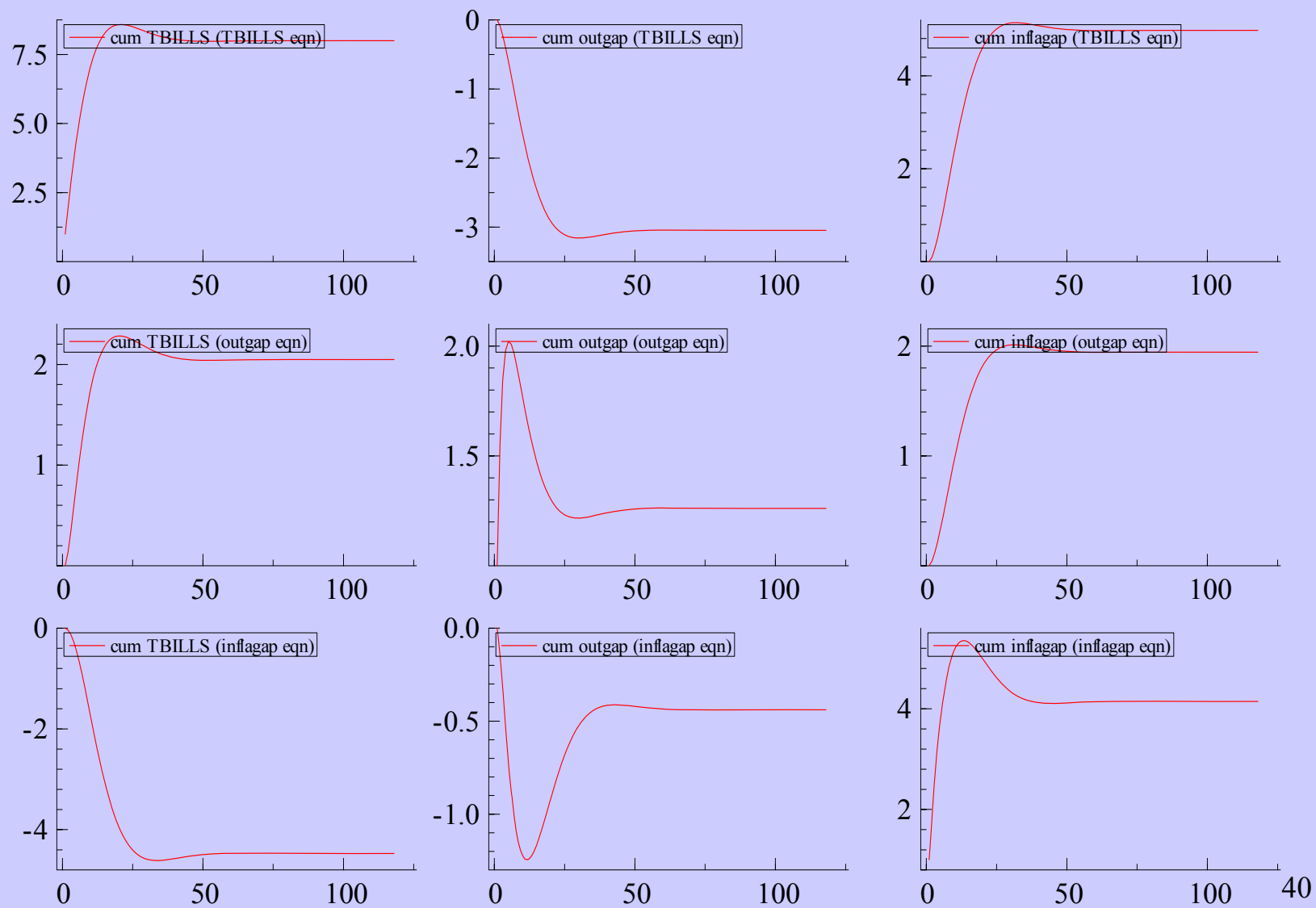
Prediction from the Cointegrating VAR Model



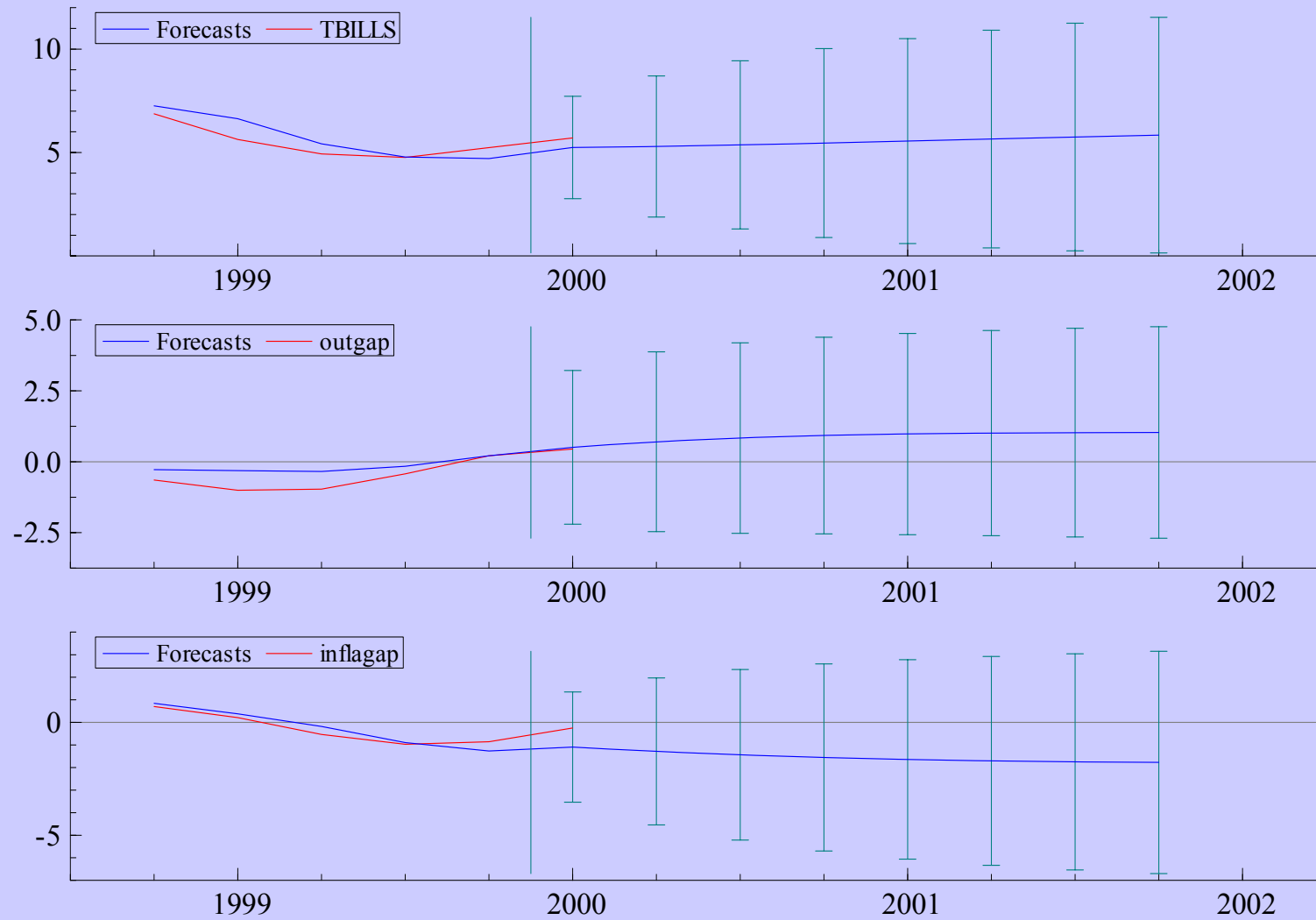
Impulse Response Analysis



Cumulative Impulse Response Analyses



Dynamic Forecasts of Interest rate, output-gap and inflation gap



Main Points of this Paper

Origin of the interest determination rule in the literature of the natural rate of unemployment hypothesis, dynamic time inconsistency and credibility and policy co-ordination at the national and international level.

The prominence of the central bank independence and rule based monetary policy in 1990s.

A simple model for interest determination and found its analytical solution using the second order difference technique.

Estimation of the model using quarterly series on treasury bills rate, growth rate of output and inflation rates for the UK and annual time series for UK and four major economies.

An evidence for such a interest rule and the interest changes to have significant impacts on output, unemployment and inflation in our estimation.

The simultaneous equation technique better than the single equation technique.

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